

Report from SEG 2010 – Denver, Colorado (16–21 October)

The 80th Annual Meeting of the Society of Exploration Geophysicists (SEG) was held in Denver, Colorado from 16 to 21 October, 2010. I attended this conference on behalf of ASEG President Phil Harman who was away at that time (see President's Piece in *Preview* 149, December 2010). The venue, Colorado Convention Center, is a large building. It was large enough to accommodate 7265 official delegates with nearly 400 exhibitors. In fact the SEG Conference only used less than half of this large conference facility. It is located two blocks from the main shopping mall of Denver, and the hotels are within a couple of blocks from the mall. The mall is only for pedestrians and bicycles except for a free shuttle bus running frequently. It was very convenient to the Convention Center.

There were 78 oral technical sessions; 13 of them running concurrently at any one time, from morning to late afternoon with about two hours for a lunch break. There is no break for morning tea or afternoon tea. As each session includes about eight presentations, over 600 papers were presented in four days. In addition, about 150 poster presentations were exhibited in the large corridor areas. When this many papers are presented, it is hard to decide which sessions to attend.

Unlike our ASEG conferences, SEG does not have an opening ceremony and plenary session for everyone to attend. Perhaps a football stadium would be needed to accommodate all these delegates! Instead, the 'SEG Honour and Award Program and Presidential Session' takes the place of the opening ceremony, where organisers welcome the delegates and past and current presidents present honours. You can find the recipients on the SEG website, but I want to mention one special award given to Mr Jerome Freel for his 75 years of membership (of SEG's 80 years history)! Unfortunately, he could not come to Denver, but a video of his recollection of early geophysics was presented at the ceremony. The 98-year old geophysicist looked well and he is still an active geophysicist. It gave some encouragement to everyone there.

The three exhibition halls were filled with about 400 exhibitors, both large and small, dominated by large seismic and petroleum service providers and contractors. The ASEG booth was in the

well away from the 'main street' of the exhibition, but a fair number of visitors came to enquire about our conference and membership. Petrosys and Down Under Geosolutions were among the exhibitors from Australia. I also met quite a few ASEG members from Australia at the booths of the multi-national companies.

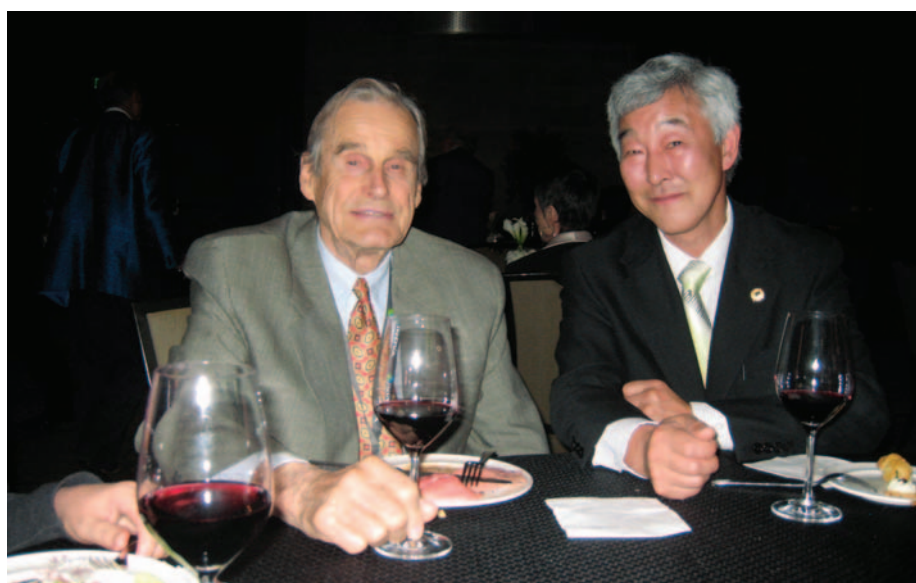
An important aspect of the SEG conventions is committee meetings in which many of the SEG activities and planning for the coming year are discussed. Among the meetings, the SEG Council meeting was the most controversial. The Executive Committee had been working on the new constitution and by-laws. It meant to rectify some inconsistencies among the constitution and by-laws in the relationship between the Executive Committee and the Council. The proposed amendment also included a reform of the Council. Currently there are over one hundred Council members, they meet only once a year and many of the attendees are not well prepared. This is hard for the Executive Committee to work with, and they wanted to reduce the number and to meet more frequently. This meant reduction of representation of the large sections like Texas and Oklahoma. By their strong opposition, the proposal was narrowly defeated. Those interested may refer to the President's Page in the December 2010 issue of *The Leading Edge* and SEG website. Other committees I attended were Global Affairs, Youth

Education and Near Surface Geophysics committees.

A special meeting between the ASEG and SEG was organised and Dennis Cooke, our President-Elect, and I explained issues particularly important to Australia: we are so far away from the centre of activities and SEG's DISC and Distinguished Lecturer tours are some of the few good opportunities to learn the forefront technology. We asked SEG to send the lecturers to many locations in Australia. We also emphasised Australia's strength in minerals geophysics and asked the SEG to consider minerals DISC; we may export lecturers to other countries where minerals exploration is a key interest like west Africa.

A conference is an opportunity to meet senior members of other societies. We had a meeting with SEGJ and KSEG presidents and their editors to discuss the details of the editorial structure of the new joint *Exploration Geophysics*, which will start in 2012.

No conference is complete without social activities. The most important social event is the 'Presidential Dinner' for the changeover of the SEG President. Invited guests queue up at the podium to greet the outgoing and incoming Presidents and First Ladies and to take a photo together. The new SEG President is Klaas Koster, the ASEG President of 2003. We collected a smorgasbord dinner and looked for a vacant seat.



Koya Suto (R) with Dr Lawrence Morley Snr at the SEG Conference 'Presidential Dinner', Denver, Colorado.

I sat at a table near the middle of the room and greeted the people sitting at the same table, introducing myself. The person next to me was Dr Lawrence Morley, who introduced his 90-year old father, also Dr Lawrence Morley, a still active geophysicist, sitting next to him. As conversation went, I found that Dr Morley Snr was one of the persons who first reported the magnetic stripe in the Atlantic Ocean. I learnt about this stripe in my student days as one of the pieces

of evidence for plate tectonics, discovered when searching for submarine by airborne magnetic survey. As it was well established and learnt from the textbook, I thought it an historical fact like Galileo and Newton's, but the living history appeared in front of my eyes! This was a big surprise of the conference.

The Conference Reception, 'An Evening of Discovery', was held at the Denver Art Museum. The whole museum was open in

the evening for us. Coincidentally, there was an exhibition of Tutankhamen and ancient Egypt, and the delegates were invited to view this splendid exhibition too. The place was so large that thousands of delegates did not feel crowded.

The conference concluded successfully, and some fruitful discussions were held between ASEG and SEG to strengthen our ties.

Koya Suto

Richard Lane – SEG's 2011 Honorary Lecturer, Pacific South



Richard Lane, well known to many of us as a regular presenter at ASEG conferences, is the SEG's Honorary Lecturer, Pacific South. Richard is a senior geophysicist in the Onshore Energy & Minerals Division at Geoscience Australia. His lecture is titled 'Building on 3D Geological Knowledge through Gravity and Magnetic Modeling Workflows at Regional to Local Scales'. Richard's

itinerary is shown in the table below. For more information, visit www.seg.org and

follow the links under the 'Education' tab.

Date	Location	Host
Thursday, 24 February	Melbourne	ASEG Victoria
Thursday, 3 March	Brisbane	ASEG Queensland
Tuesday, 8 March	Adelaide	ASEG South Australia/Uni of Adelaide Student Chapter
Wednesday, 30 March	Sydney	ASEG New South Wales
Wednesday, 30 March	Sydney	University of Sydney
Tuesday, 5 April	Crawley	University of Western Australia SEG Student Chapter
Wednesday, 6 April	Perth	ASEG Western Australia
Wednesday, 20 April	Canberra	ASEG Australian Capital Territory
Tuesday, 10 May	Wellington, NZ	Wellington Geoscientists
Wednesday, 11 May	Dunedin, NZ	University of Otago Geophysics Society
Friday, 20 May	Melbourne	Monash University
Tuesday, 14 June	Kuala Lumpur, Malaysia	SEG Malaysia
Friday, 17 June	Manila, Philippines	SEAPEX

ASEG 2012 22nd ASEG Conference and Exhibition News Update (03)

After a short break the COC will meet (at time of writing) in late January. We are hoping the weather in 2012 will be a kinder, gentler version of 2011. Koya Suto has been busy gathering candidates for his workshops sub-committee and has approached presenters. Potential keynote speakers have also been approached.

Please visit our website at www.aseg2012.com.au to lodge an expression of interest.

Co-Chairs: Wayne Mogg & Andrea Rutley
Technical: Binzhong Zhou

Sponsorship: Ron Palmer & Howard Bassingthwaighte

Exhibition: Gary Butler & Dave Burt/
John Donohue

Finance: Noll Moriarty

Workshops: Koya Suto

Publicity: Henk van Paridon

Students: Shaun Strong

Social: Janelle Kuter

Anyone able to help (urgent request for people to help with papers) should contact Binzhong, Wayne or Andrea.



The conference theme, 'Unearthing New Layers' was chosen to highlight how resources can exist in places that we have already explored and how geophysical data can be re-examined to help see them. The logo is a stylised map of Queensland with a standard colour look-up showing the sea in blue and the earth in red.

Henk van Paridon

\$376 M for new ARC research projects – \$18 M less than last year

The Minister for Innovation, Industry, Science and Research, Senator Kim Carr, on 25 October 2010, announced total funding of over \$376 million for 1128 new research projects to be funded through the Australian Research Council's National Competitive Grants Program. This is a decrease of \$18 million or 4.5% compared with the 2009 allocations.

All these projects are funded through the Council's *Discovery Indigenous Researchers Development*, *Discovery Projects* and *Linkage Projects* schemes (see <http://www.arc.gov.au/applicants/fundingoutcomes.htm>).

For a government that prides itself on supporting research and innovation, the continual reduction in funds, in real terms, for basic research is unacceptable. The tables later in this article tell a very disappointing story.

Of the three schemes, *Discovery Projects* captured the bulk of the money with \$318.2 million committed to 931 projects; followed by \$56.2 million for 186 *Linkage Projects* and \$2.0 million for 11 *Discovery Indigenous Researchers Development*.

Discovery Projects still hard to get with 22% success rate

Discovery Projects are the main vehicles for funding basic research in tertiary institutions. Table 1 summarises the funds provided since 2005. There are several worrying trends.

First, in real terms (CPI adjusted) the total funding provided for Discovery Projects has declined by 7% since 2005. Although the total funds have increased by 8% since 2005, the CPI index has increased by about 15% in the same

period. Second, the success rate of 22% remains low and it has declined since 2005 when it was nearly 31%. It is hard to imagine that something like 80% of the proposals were not worth funding. Finally, the average size of each grant has only increased by approximately 2% in dollar terms since 2007 (~\$334k up to ~\$342k), whereas the CPI will increase by at least 10% in the same period. So the average 'real value' has declined.

One can only conclude that the government's funding for basic research through the ARC is slowly declining, irrespective of which government is in power.

Thirty-five tertiary institutions were successful in obtaining grants. Ten universities received funding of more than \$10million for Discovery Projects starting in 2011; compared to eight for projects starting in 2010. The top ten universities are shown in Table 2, together with last year's results. Apart from The University of Newcastle replacing the University of Wollongong the same universities occupy the top ten places in the league. However, the order in the table has changed significantly. Melbourne still takes the number one spot, but Sydney has slipped from being second to fifth and Monash has jumped from sixth to second.

As expected the Group of Eight Universities occupy the top positions in the table with Adelaide hanging on to eighth place.

Linkage Grants deliver better success rates but funding reduced

The Linkage Projects scheme funds collaborative projects between university researchers and Partner Organisations. These projects encourage and develop long-term strategic research alliances between higher education organisations and other organisations, including within industry, in order to apply advanced knowledge to problems and/or to provide opportunities to obtain national economic, social or cultural benefits.

Of the 398 Linkage Projects proposals considered for 2011 Round 1, 186 were approved with a total approved funding, over the life of these projects, of \$56.2million. There are 407 Partner Organisations involved with these

Table 1. Discovery Project funding 2006–2011*

	2005	2006	2007	2008	2009	2010	2011
Applications considered	3413	3742	4033	4112	4152	4068	4230
Applications funded	1053	917	822	878	845	925	931
Success rate (%)	30.9	24.5	20.4	21.4	20.4	22.7	22.0
Average total grant size	\$280 627	\$298 350	\$334 267	\$342 593	\$341 344	\$351 973	\$341 743
Total funds requested (\$M)	\$443.7	\$496.1	\$502.1	\$532.0	\$2106.3	\$2097.8	\$2203.6
Total funds approved (\$M)	\$295.5	\$273.6	\$274.8	\$300.8	\$288.4	\$325.6	\$318.2
Average first year funding	\$94 340	\$103 768	\$105 019	\$106 469	\$116 055	\$109 179	\$108 467

*None of the dollar numbers have been adjusted for inflation.

Table 2. Top Ten Universities for Discovery Projects starting in 2011

Administering organisation	Proposals approved	Total ARC funding	2010 comparison
The University of Melbourne	107	\$37 566 056	\$38 821 177
Monash University	93	\$35 273 201	\$29 015 749
The Australian National University	92	\$33 794 578	\$35 697 944
The University of Queensland	94	\$33 319 278	\$36 685 217
The University of Sydney	102	\$33 003 498	\$38 164 052
The University of New South Wales	85	\$25 647 887	\$36 381 799
The University of Western Australia	37	\$12 891 105	\$16 144 610
The University of Adelaide	36	\$12 435 897	\$10 587 493
The University of Newcastle	31	\$11 497 063	\$8 201 000
Macquarie University	35	\$11 345 589	\$9 177 180

Table 3. Comparison of funding allocations over the project life for approved Linkage Projects from Round One 2006 to Round One 2011

Funding round	Applications considered	Number approved	Success rate (%)	Requested funds over project life (approved proposals) (\$)	Funds granted over project life (\$)
Rd 1 2006	529	194	36.7	70511313	58524390
Rd 2 2006	577	206	35.7	68502938	53980315
Rd 1 2007	485	208	42.9	80426175	59434944
Rd 2 2007	472	217	46.0	79990761	60313034
Rd 1 2008	424	202	47.6	78546893	62267846
Rd 2 2008	487	208	42.7	93414877	63717139
Rd 1 2009	441	218	49.4	106032303	71704687
Rd 2 2009	522	239	45.8	105186071	71856782
Rd 1 2010	470	211	44.9	94619567	66827891
Rd 2 2010	512	218	42.6	98419105	66753570
Rd 1 2011	398	186	46.7	82443432	56235992

projects and they have pledged a total (cash and in-kind) of \$117.2 million. This represents \$2.08 from Partner Organisations for every dollar funded by the Australian Government. A very good investment of taxpayers' money.

Geophysics fared better with Linkage Projects. Although, out of the 186 projects approved only six were placed under the Earth Science heading, four of these have strong links to geophysics. Congratulations to ASEG members Nicholas Direen, Nicholas Rawlinson and Malcolm Sambridge for their efforts in obtaining substantial research funding. Summaries of these projects are listed later in this article.

Table 3 summarises the results for the period 2006–2011. The current success rate of 46.7% for Linkage Projects is approximately twice the success rate for

Discovery Projects – so Linkage Projects are the ones to go for. However, they are usually harder to develop because there has to be negotiations and legal agreements with several partners in the team – and these can be time consuming.

Table 3 also shows how the average dollars per project grant has remained approximately the same over the last six years. This means that, as with the Discovery Projects, their real value has declined because of inflation. Furthermore the 12 Australian Postdoctoral Fellowships (Industry) are also funded from Linkage Project funds.

Thirty-six tertiary institutions applied for Linkage Grants and 31 were successful. The Top Ten Universities for Linkage Project funding are shown in Table 4. The Group of Eight Universities fill the first six places with The University of

New South Wales at the top of the list. The University of South Australia did very well, obtaining more funding than either the Universities of Sydney or Adelaide. It is worthwhile noting that if the ARC funding is added to the partner funding, then The University of Melbourne takes first place with \$27.1 million, just edging out The University of New South Wales on \$26.1 million.

Earth science-related Discovery Projects

The exploration-related Earth Science Discovery Projects are listed below. Out of the 931 projects approved only 41 were listed under the Earth Science umbrella and of these only nine could be classified as exploration-related. These are listed below.

The effective strength of oceanic plate bounding faults

Researchers: Craig J O'Neill and Juan C Afonso

Funding: 2011, \$65 000; 2012, \$65 000; 2013, \$65 000.

Administering Organisation: Macquarie University

Project Summary: This project will address the anomalously weak behaviour of the seismically active faults on the boundary of the Australian plate, in three key geodynamic areas. This will constrain the mechanisms which weaken such faults, and produce a model for their effective strength and evolution over geological timescales their effective strength and evolution over geological timescales.

Table 4. Top Ten Universities Linkage Projects 2011 Round One – Funding outcomes

Administering organisation	Proposals considered	Proposals approved	Success rate (%)	ARC funding over project life (approved proposals) (\$)	Partners' contributions (cash & in-kind) over project life (\$)
The University of New South Wales	50	30	60.0	8 343 201	17 805 772
The University of Western Australia	17	13	76.5	5 969 571	10 424 997
The University of Melbourne	31	14	45.2	5 272 125	21 834 850
The Australian National University	18	12	66.7	4 611 926	9 594 889
Monash University	18	12	66.7	4 330 273	8 024 433
The University of Queensland	29	16	55.2	3 583 424	6 329 303
University of South Australia	17	7	41.2	2 318 222	3 945 160
The University of Sydney	23	9	39.1	2 292 474	4 986 490
The University of Adelaide	12	7	58.3	2 136 406	3 783 464
The University of Newcastle	13	5	38.5	1 998 949	2 939 417

Three dimensional geospatial model of the Australian continent from geologically constrained inverse modelling of the Earth's gravity and magnetic fields

Researchers: Peter G Betts, Laurent Ailleres, Mark W Jessell and Eric A de Kemp

Funding: 2011, \$100 000; 2012, \$70 000; 2013, \$90 000.

Administering Organisation: Monash University

Project Summary: This project enhances Australia's reputation in integration of geology and geophysics and will create a three dimensional model of the Australian crust that will image and define the geometry of the fundamental building blocks of the continent. The outcomes will create new concepts for resource exploration and hazard recognition.

The link between the deep Earth and its dynamic surface

Researchers: Fabio A Capitanio, Louis N Moresi and Philip Allen

Funding: 2011, \$80 000; 2012, \$60 000; 2013, \$60 000.

Administering Organisation: Monash University

Project Summary: Modelling the two-way interaction of plate tectonics with the actions of erosion and sedimentation gives a fundamentally new view of the dynamics of our planet and the importance of the surface on the deep interior. It will improve our understanding of the formation of sedimentary basins, their evolution and their preservation over geological time.

Three-dimensional subduction models of overriding plate deformation and mantle flow using laboratory and numerical methods

Researchers: Wouter P Schellart, Alexander R Cruden and David R Stegman

Funding: 2011, \$100 000; 2012, \$90 000; 2013, \$80 000.

Administering Organisation: Monash University

Project Summary: This project investigates the interaction of the Earth's tectonic plates at subduction zones, places where one plate sinks below another plate into the Earth. This is important for understanding the evolution of the

Australian plate that has active subduction zones to the north and east, and how its geological evolution is controlled by subduction.

New observational constraints on 2004–2007 rupture of the Sumatra megathrust

Researcher: Phil R Cummins

Funding: 2011, \$110 000; 2012, \$110 000; 2013, \$100 000.

Administering Organisation: The Australian National University

Project Summary: This project will develop innovative methods and generate new data for studying the rupture of giant subduction zone earthquakes and the generation of destructive tsunamis. This will lead to a better understanding of these phenomena that will enhance our ability to forecast, warn and map the hazards associated with them.

Frequency-dependent seismic properties of cracked and fluid-saturated crustal rocks: a systematic laboratory study

Researchers: Ian Jackson and Douglas R Schmitt

Funding: 2011, \$50 000; 2012, \$50 000; 2013, \$40 000.

Administering Organisation: The Australian National University

Project Summary: Novel experimental techniques will be used to build a better laboratory-based understanding of the seismic properties of fluid-saturated crustal rocks. The outcome will be an improved capacity to monitor the presence of fluids in diverse situations ranging from geothermal power generation and waste disposal to earthquake fault zones.

Taming the nonlinearity of geophysical inversions

Researchers: Malcolm Sambridge and Brian L Kennett

Funding: 2011, \$115 000; 2012, \$120 000; 2013, \$130 000; 2014, \$33 000.

Administering Organisation: The Australian National University

Project Summary: This project will develop new ways to extract information from complex geophysical data sets used to construct images of the Earth's interior. Applications will be important to

indirect imaging problems in the physical and engineering sciences and particularly to the discovery of resources within the Earth upon which Australian society is dependent.

Southern Ocean storms and noise sources from Australian seismic array recordings

Researchers: Anya M Reading and Keith D Khoper

Funding: 2011, \$70 000; 2012, \$70 000.

Administering Organisation: University of Tasmania

Project Summary: Storm severity in the Southern Ocean – is it increasing? This project will investigate storminess using decades of seismic records from Australian stations, adding unique data for remote ocean areas with no direct weather observations, with profound implications for the global climate system.

Precision inertial sensing with cold atoms

Researchers: John D Close, Nicholas P Robins, Wolfgang Ether and Ernst M Resell

Funding: 2011, \$120 000; 2012, \$110 000; 2013, \$110 000.

Administering Organisation: Macquarie University

Project Summary: Many advances in our technology-driven society rely on precision measurement. The project will provide the Australian industrial and government sectors with new and better inertial sensors to measure acceleration, rotation and gravity. The technology will find application in navigation, defence, mineral exploration, earth science and fundamental physics.

Earth science-related Linkage Projects

The exploration-related Earth Science Linkage Projects are listed below. Out of the 186 projects approved only six were placed under the Earth Science heading but four of these have strong links to geophysics. These are listed below.

Chemical optimisation of geothermal heat extraction

Researchers: Katy A Evans and Hue Tong Chua

Collaborating Organisations: Geothermal Power Pty Ltd and Greenock Energy

Administering Organisation: Curtin University of Technology

Funding: 2011, \$50 000; 2012, \$50 000; 2013, \$40 000.

Project summary: Geothermal energy can contribute to our energy needs, but we must understand chemical interactions between geothermal fluids, the host aquifers and the engineered environment to use the energy safely and efficiently. This project will assess those interactions, provide guidelines for geothermal energy use and train future geothermal scientists.

Four dimensional lithosphere evolution and controls on mineral system distribution in Neoproterozoic to Paleoproterozoic terranes

Researchers: Thompson C McCuaig, Mark E Barley, Marco Fiorentini, Anthony I Kemp, John M Miller, Elena Belousova, Mark W Jessell, Kim A Hein, Graham C Begg, Janet Tunjic, Thomas Angerer, Nuru Said and Leon Bagas

Collaborating Organisations: AMIRA International Ltd, AngloGold Ashanti, Gold Fields and the Northern Territory Geological Survey

Administering Organisation: The University of Western Australia

Funding: 2011, \$540 000; 2012, \$520 000; 2013, \$560 000.

Project Summary: This project will resolve important questions about the links between the evolution and preservation of continents and important mineral deposits in Australia and West Africa between 2.7 and 1.8 billion years ago. The results will improve the understanding of a key period of Earth history and make a major contribution to mineral exploration.

Earthquake hazard in Indonesia

Researchers: Phil R Cummins, Paul Tregoning, Malcolm Sambridge, Sri Widiyantoro and Fauzi

Collaborating Organisation: Australian Agency for International Development

Administering Organisation: The Australian National University

Funding: 2011, \$300 000; 2012, \$250 000; 2013, \$250 000.

Project Summary: This project will deliver breakthrough science that will strengthen Indonesia's ability to reduce its vulnerability to earthquake disasters. This will be achieved through a collaboration of Australian and

Indonesian scientists who will fundamentally improve understanding of the destructive potential of Indonesian earthquakes.

Beneath Bass Strait: linking Tasmania and mainland Australia using a novel seismic experiment

Researchers: Nicholas Rawlinson, Anya M Reading and Nicholas G Direen

Collaborating Organisations: FrOG Tech, GeoScience Victoria and Mineral Resources Tasmania

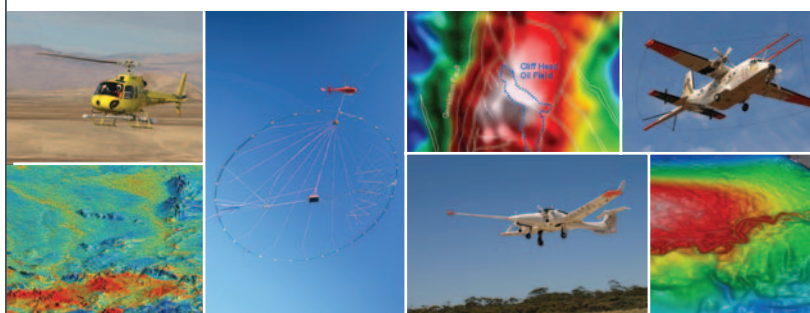
Administering Organisation: The Australian National University

Funding: 2011, \$70 000; 2012, \$90 000; 2013, \$54 000.

Project Summary: A new low-cost approach based on background seismic energy and earthquake recordings will be used to construct three-dimensional maps of the deep structure beneath Bass Strait. Understanding the broad scale geology of southeast Australia is of national importance because the area is host to an abundance of petroleum, geothermal and mineral resources.

David Denham

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Update on Geophysical Survey Progress from the Geological Surveys of New South Wales, Tasmania, Western Australia, and Geoscience Australia (information current at 17 January 2011)

Tables 1–3 show the continuing acquisition by the States, the Northern Territory and Geoscience Australia of new gravity, airborne magnetic and radiometrics, and airborne EM over the Australia continent. All surveys are being managed by Geoscience Australia.

There are thirteen new airborne magnetic and radiometric surveys reported in this issue. Twelve of these new surveys are funded under the WA Exploration Incentive Scheme – Phase 3. Figures 1–12 show detailed survey boundaries. In total, more than

1.5 million line kilometres of data will be collected over an area of approximately 342 000 km² with line spacings of 200 m, 400 m, or 800 m. Figure 13 shows a new survey off the east coast of Tasmania which will cover an area of 19 570 km² with 800 m line spacing data.

Table 1. Airborne magnetic and radiometric surveys

Survey name	Client	Contractor	Start flying	Line (km)	Spacing AGL Dir	Area (km ²)	End flying	Final data to GA	Locality diagram (Preview)	GADDS release
South Officer 1 (Jubilee)	GSWA	Thomson	1 June 10	180 000	200 m 50 m N–S	32 380	28.1% complete @ 16 Jan 11	TBA	148 – Oct 10 p23	TBA
South Officer 2 (Waigen – Mason)	GSWA	Thomson	28 June 10	113 000	400 m 60 m N–S	39 890	100% complete @ 5 Jan 11	TBA	148 – Oct 10 p24	TBA
East Canning 3 (Stansmore)	GSWA	Thomson	14 July 10	114 000	200 m (east) 400 m (west) 50 m N–S	25 934	100% complete @ 2 Nov 10	TBA	148 – Oct 10 p24	TBA
Eucla Basin 2 (Loongana)	GSWA	Fugro	20 June 10	113 000	200 m 50 m N–S	20 320	100% complete @ 3 Dec 10	TBA	148 – Oct 10 p24	TBA
Eucla Basin 4 (Madura)	GSWA	Fugro	1 July 10	102 000	200 m 50 m N–S	18 220	100% complete @ 22 Nov 10	TBA	148 – Oct 10 p24	TBA
Eucla Basin 5N (Forrest)	GSWA	Fugro	16 June 10	75 000	200 m 50 m N–S	13 040	100% complete @ 12 Sep 10	TBA	148 – Oct 10 p25	TBA
Eucla Basin 5S (Eucla)	GSWA	Fugro	6 July 10	87 500	200 m (onshore) 400 m (offshore) 50 m (onshore) 100 m (offshore) N–S	16 100	100% complete @ 5 Nov 10	TBA	148 – Oct 10 p25	TBA
South Canning 1 (Madley – Herbert)	GSWA	UTS	19 July 10	95 000	400 m 60 m N–S	33 520	100% complete @ 12 Nov 10	TBA	148 – Oct 10 p25	TBA
South Canning 2 (Morris – Herbert)	GSWA	UTS	1 July 10	125 000	400 m 60 m N–S	45 850	100% complete @ 11 Jan 11	TBA	148 – Oct 10 p25	TBA
North Canning 4 (Lagrange – Munro)	GSWA	UTS	20 September 10	103 000	400 m 60 m N–S	36 680	68% complete @ 9 Jan 11	TBA	148 – Oct 10 p26	TBA
Southeast Lachlan	GSNSW	Fugro	1 March 10	107 533	250 m (NSW) 500 m (ACT) E–W	24 660	100% on 9 Sep 10	TBA	144 – Feb 10 p15	TBA
West Kimberley	GSWA	TBA	TBA	134 000	800 m 60 m N–S Charnley: 200 m 50 m N–S	42 000	TBA	TBA	This issue (Figure 1)	TBA

Table 1. *Continued*

Survey name	Client	Contractor	Start flying	Line (km)	Spacing AGL Dir	Area (km ²)	End flying	Final data to GA	Locality diagram (Preview)	GADDS release
Perth Basin North (Perth Basin 1)	GSWA	TBA	TBA	96 000	400 m 60 m E–W	30 000	TBA	TBA	This issue (Figure 2)	TBA
Perth Basin South (Perth Basin 2)	GSWA	TBA	TBA	88 000	400 m 60 m E–W	27 500	TBA	TBA	This issue (Figure 3)	TBA
Murgoo (Murchison 1)	GSWA	TBA	TBA	128 000	200 m 50 m E–W	21 250	TBA	TBA	This issue (Figure 4)	TBA
Perenjori (Murchison 2)	GSWA	TBA	TBA	120 000	200 m 50 m E–W	20 000	TBA	TBA	This issue (Figure 5)	TBA
South Pilbara	GSWA	TBA	TBA	136 000	400 m 60 m N–S	42 500	TBA	TBA	This issue (Figure 6)	TBA
Carnarvon Basin North (Carnarvon Basin 1)	GSWA	TBA	TBA	104 000	400 m 60 m E–W	32 500	TBA	TBA	This issue (Figure 7)	TBA
Carnarvon Basin South (Carnarvon Basin 2)	GSWA	TBA	TBA	128 000	400 m 60 m E–W	40 000	TBA	TBA	This issue (Figure 8)	TBA
Moora (South West 1)	GSWA	TBA	TBA	128 000	200 m 50 m E–W	21 250	TBA	TBA	This issue (Figure 9)	TBA
Corrigin (South West 2)	GSWA	TBA	TBA	120 000	200 m 50 m E–W	20 000	TBA	TBA	This issue (Figure 10)	TBA
Cape Leeuwin – Collie (South West 3)	GSWA	TBA	TBA	105 000	200/400 m 50/60 m E–W	25 000	TBA	TBA	This issue (Figure 11)	TBA
Mt Barker (South West 4)	GSWA	TBA	TBA	120 000	200 m 50 m N–S	20 000	TBA	TBA	This issue (Figure 12)	TBA
Offshore East Coast Tasmania	MRT	TBA	TBA	30 895	800 m 90 m E–W	19 570	TBA	TBA	This issue (Figure 13)	TBA

TBA, To be advised.

Table 2. Gravity surveys

Survey name	Client	Contractor	Start survey	No. of stations	Station spacing (km)	Area (km ²)	End survey	Final data to GA	Locality diagram (Preview)	GADDS release
Albany – Fraser North	GSWA	Atlas	21 Oct 2010	9200	2.5 km regular	50 980	87% on 24 Dec 2010	TBA	146 – Jun 10 p17	TBA
Sandstone	GSWA	IMT	Early Oct 2010	6300	2.5 km regular	35 640	100% on 17 Dec 2010	TBA	146 – Jun 10 p17	TBA
South Gascoyne	GSWA	IMT	9 Aug 2010	9700	2.5 km regular	55 760	100% on 27 Oct 2010	TBA	146 – Jun 10 p17	TBA

TBA, To be advised.

Table 3. Airborne electromagnetic surveys

Survey name	Client	Contractor	Start survey	Line (km)	Spacing AGL Dir	Area (km ²)	End survey	Final data to GA	Locality diagram (Preview)	GADDS release
Frome	GA	Fugro	22 May 10	34 986	5000 and 2500 100 m E–W	95 450	100% on 31 Oct 2010	TBA	146 – Jun 10 p18	TBA

TBA, To be advised.

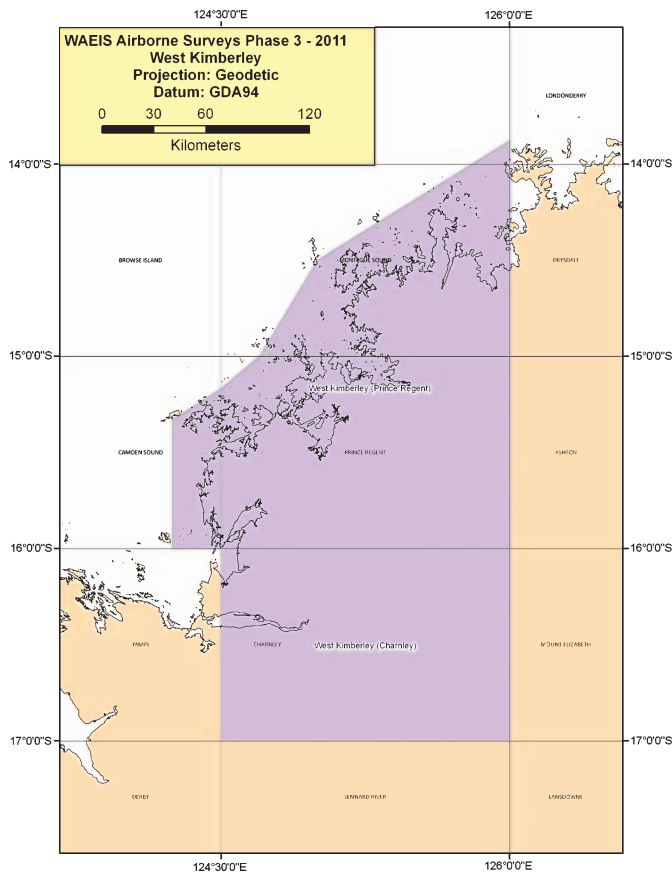


Fig. 1. Location diagram for the West Kimberley airborne mag/rad survey.

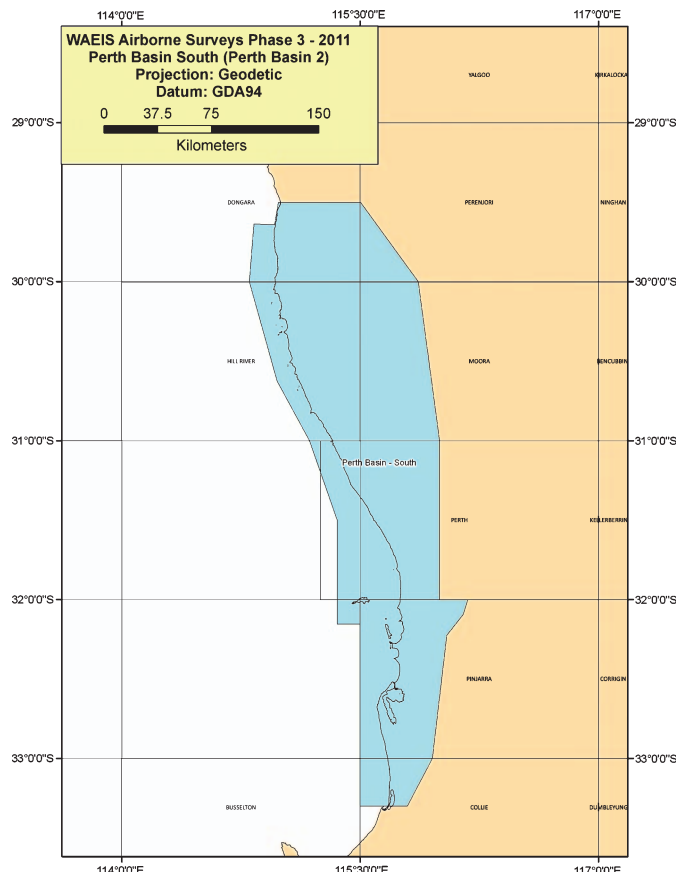


Fig. 3. Location diagram for the Perth Basin South airborne mag/rad survey.

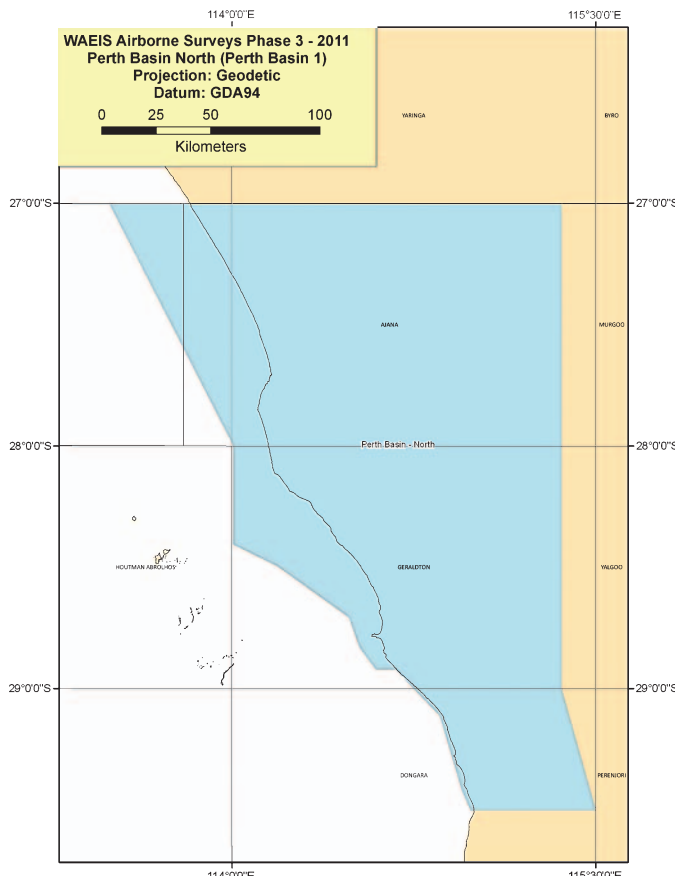


Fig. 2. Location diagram for the Perth Basin North airborne mag/rad survey.

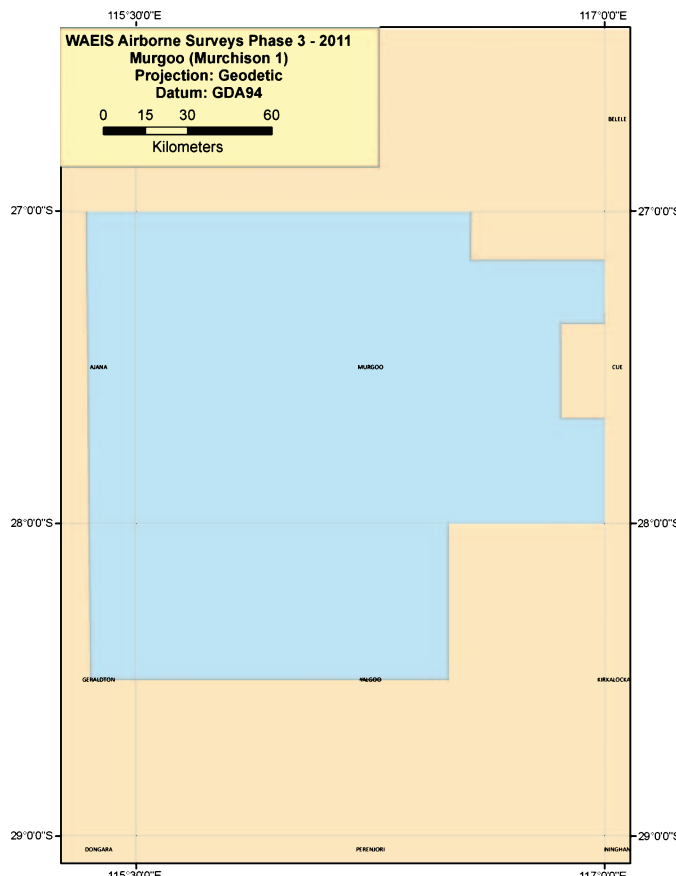


Fig. 4. Location diagram for the Murgoo airborne mag/rad survey.

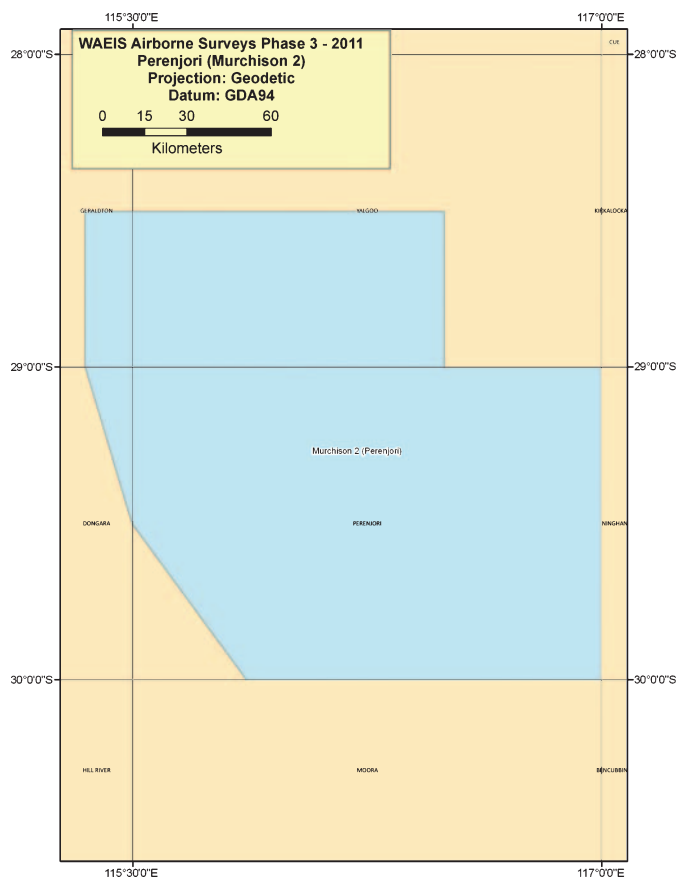


Fig. 5. Location diagram for the Perenjori airborne mag/rad survey.

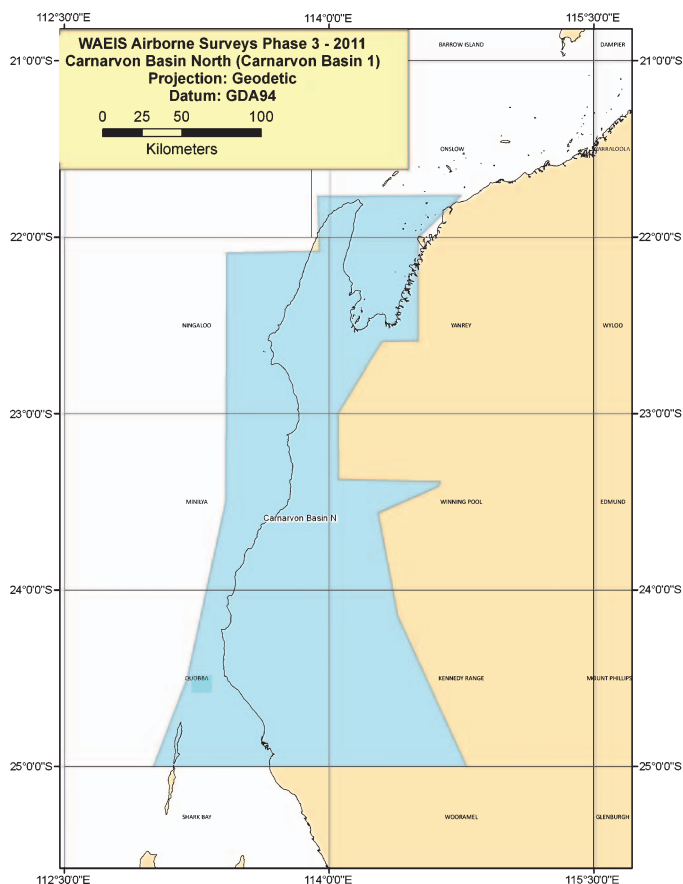


Fig. 7. Location diagram for the Carnarvon Basin North airborne mag/rad survey.

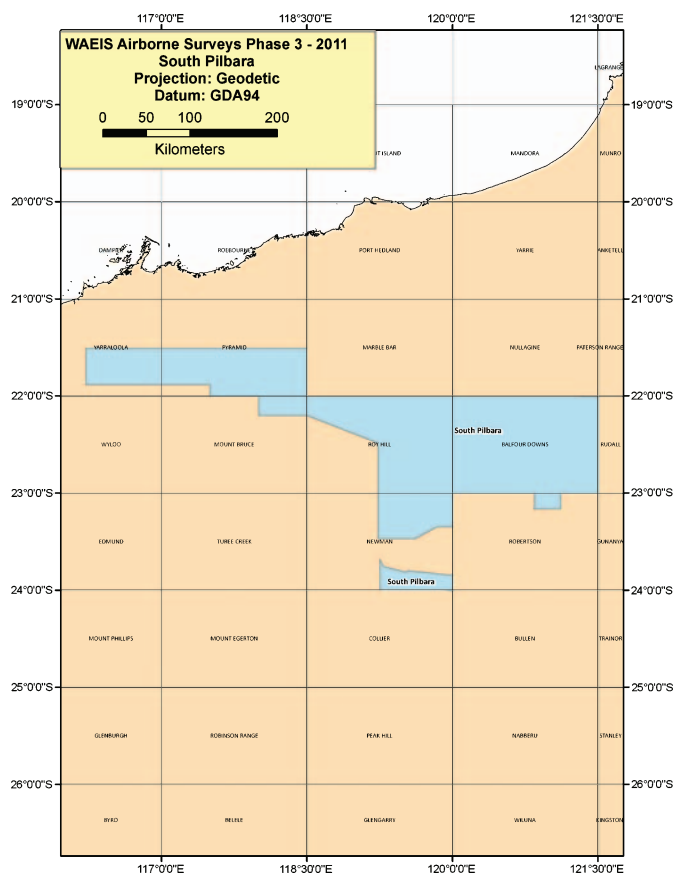


Fig. 6. Location diagram for the South Pilbara airborne mag/rad survey.

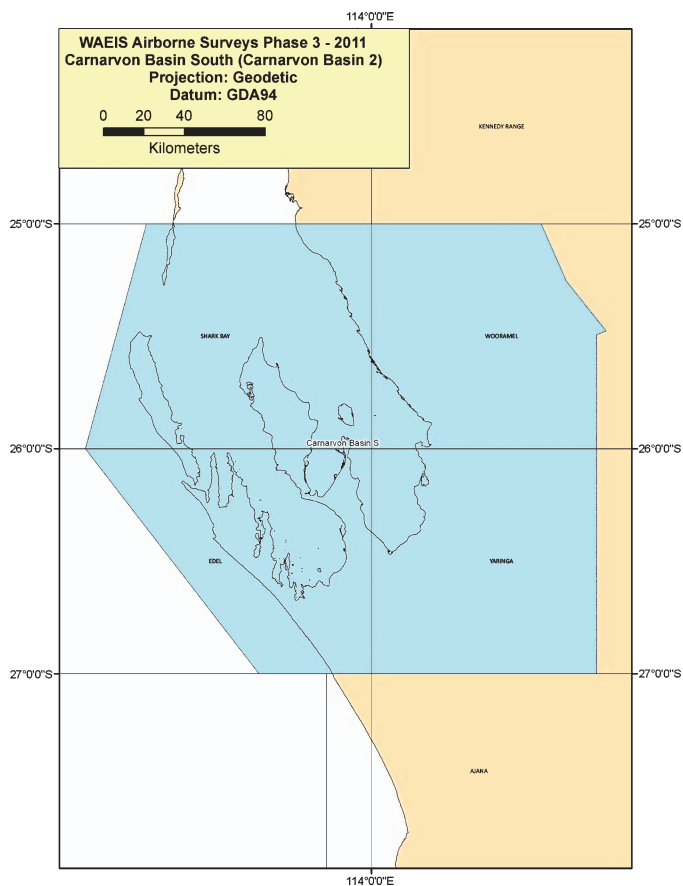


Fig. 8. Location diagram for the Carnarvon Basin South airborne mag/rad survey.

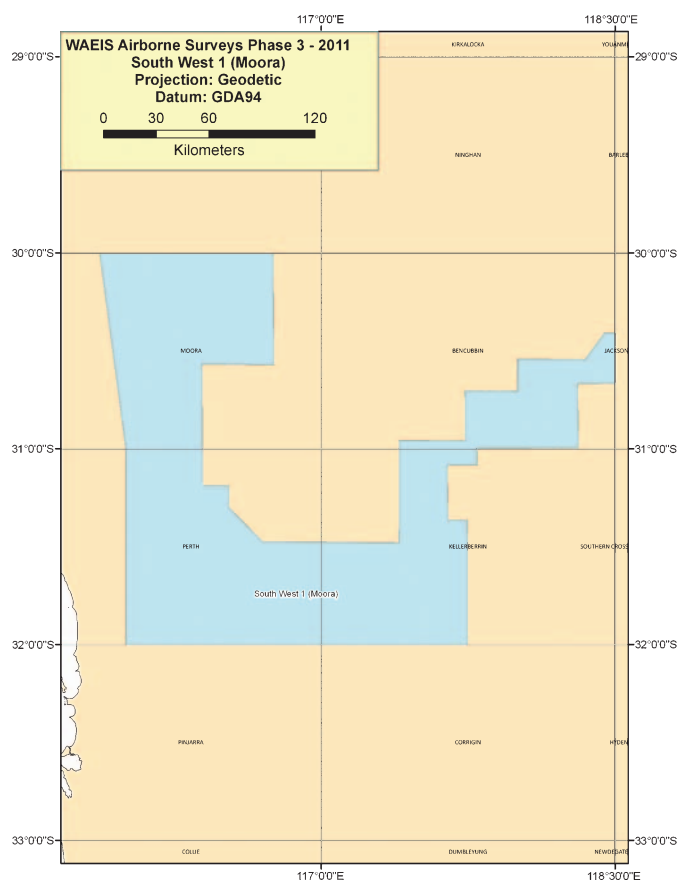


Fig. 9. Location diagram for the Moora airborne mag/rad survey.

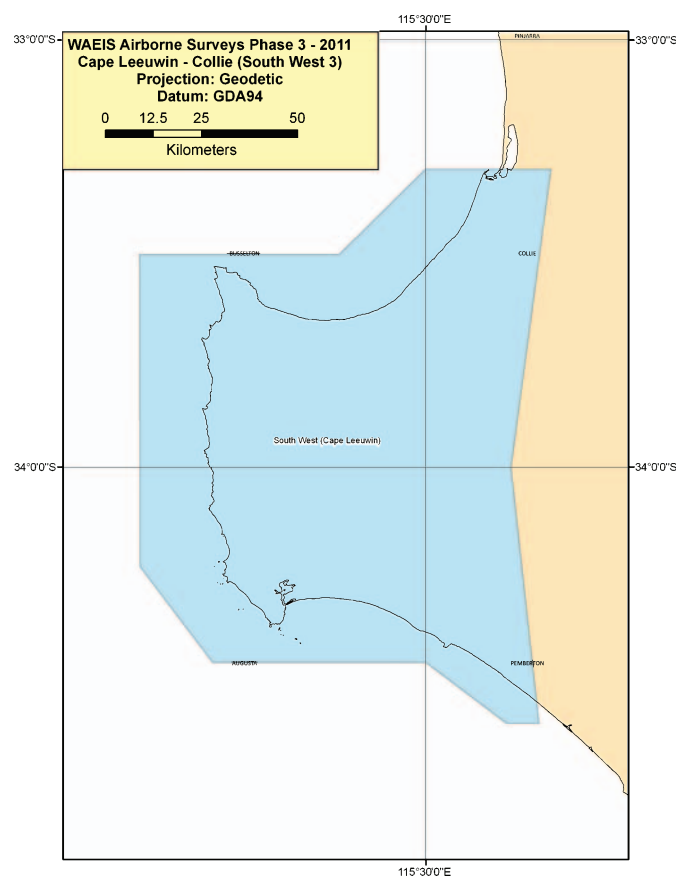


Fig. 11. Location diagram for the Cape Leeuwin – Collie airborne mag/rad survey.

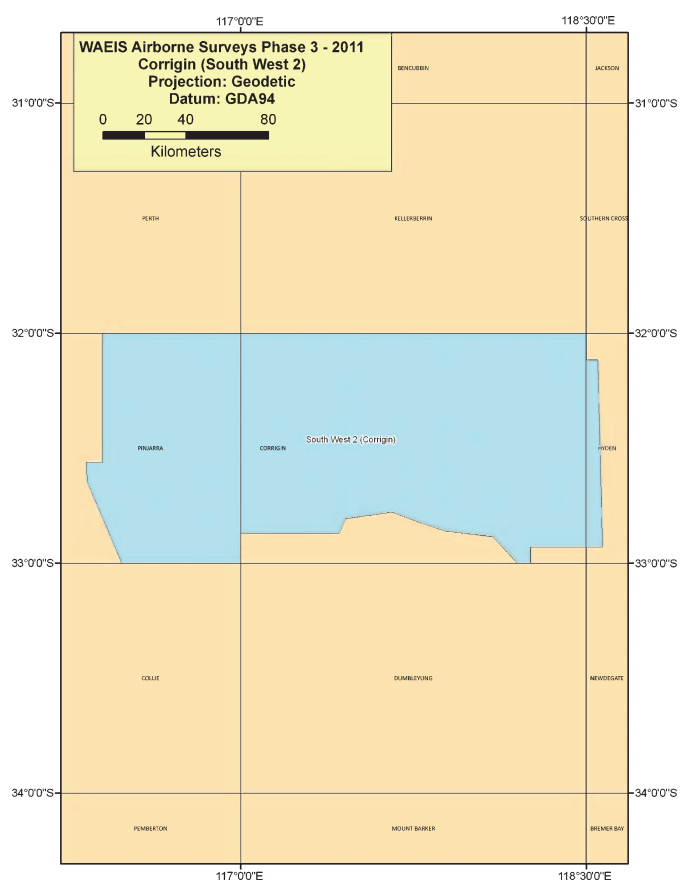


Fig. 10. Location diagram for the Corrigin airborne mag/rad survey.

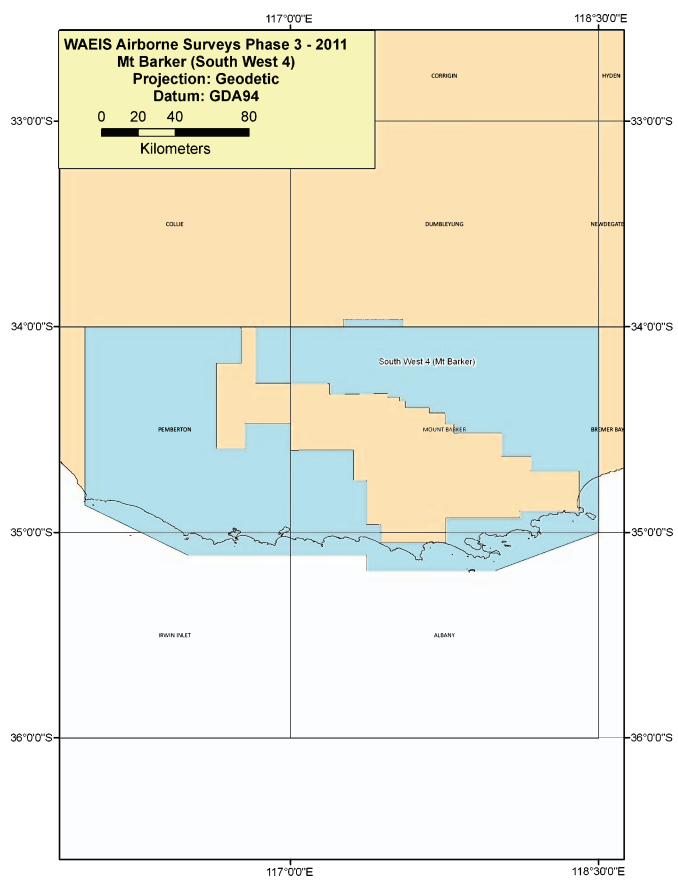


Fig. 12. Location diagram for the Mt Barker airborne mag/rad survey.

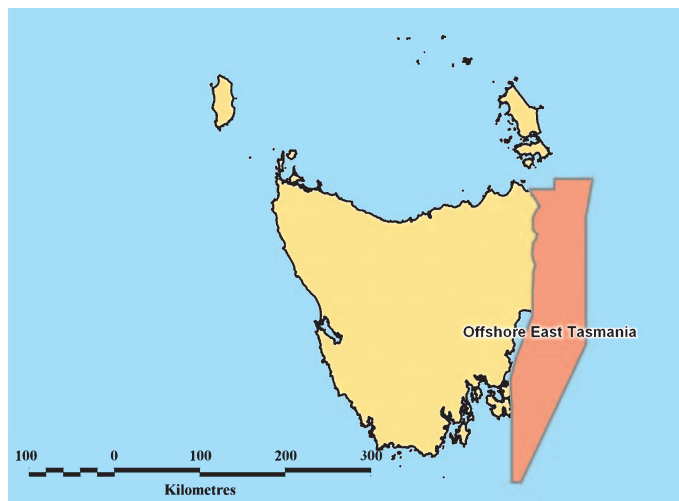



Fig. 13. Location diagram for the Offshore East Coast Tasmania airborne mag/rad survey.



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Resource industries prospered in 2010

Resource stocks provide solid growth

Resource companies continued to recover in 2010 from the 2008/09 Global Financial Crisis, but there was significant volatility in the first half of the year. However, from May onwards the upward trend stabilised. Figure 1 shows, for the period 2006 through 2010, the total market capital of the resource stocks listed in the ASX's top 150 companies, the All Ords Index and the results for the two largest resource companies BHP and RioTinto.

Notice that the resource companies out-performed the All Ords Index throughout 2010. In fact the All Ords index fell by 0.7% during 2010 whereas the market capital of the resource stocks in the top 150 grew by 10%. By the end of 2010 there were 38 resource companies involved in minerals and energy exploration listed in the top 150 companies on the ASX. This compares with 33 at the start of 2010 and only 17 at the end of 2006.

When there are 38 companies there are bound to be winners and losers. The big winners were the rare earth company, Lynas Corporation Ltd (up 227%, to \$3.4 billion), the coal company, Riversdale Mining Ltd (up 189% to \$4.0 billion), and another rare earth player, Iluka (up 155% to \$3.8 billion). There were not many losers, but the RioTinto owned uranium company, Energy Resources of Australia Ltd, fell by 53% to \$2.1 billion, Aquarius Platinum fell by 27% to 2.5 billion, and RioTinto itself fell by 18% to \$37.2 billion. Of the other majors, BHP only managed steady growth of 10% to \$151.9 billion, while gold producer, Newcrest, grew by 81% to \$30.9 billion and Fortescue Iron grew by 48% to \$20.4 billion.

More companies, more takeovers

With so many smaller companies entering the resource business it was not surprising that there was an increase in takeover

activity, particularly by overseas companies and in the second half of the year. In August 2010, Queensland based LNG company, **Arrow Energy**, valued then at \$3.4 billion was acquired by Shell and PetroChina. The takeover followed an offer in March to purchase all the shares of Arrow on a 50/50 basis. Arrow joined the Top 150 companies in February 2008 and its value rose rapidly with the recent interest in coal seam gas (see *Preview* November 2010).

Australia's top gold miner, Newcrest Mining, finally acquired **Lihir Gold Ltd** in September. It paid \$9.5 billion for Lihir to create the world's fourth-largest listed gold miner. Lihir Gold Ltd was first listed on the ASX in October 1995 and since 2000 its market capital rose from approximately \$700 million to \$10.6 billion in September this year (see *Preview* December 2010).

In November, Thailand's Banpu Plc bought **Centennial Coal** for \$2.45 billion. Centennial operated nine coal mines, mainly in the Hunter Valley, NSW. Ironically Banpu, which launched the bid in July 2010, does not operate any coal mines in Thailand because of environmental restrictions.

Canada's Goldcorp acquired **Andean Resources** for \$C3.6 billion in December. Andean operated the Cerro Negro epithermal gold deposit in Argentina and at the time of the takeover it had a market capital of \$3.7 billion on the ASX. Goldcorp has its headquarters in Vancouver, employs more than 14 000 people and claims to be North America's fastest growing senior gold producer. It operates gold mines in Canada, Mexico, Guatemala, the United States and Argentina.

Finally, in late December 2010, RioTinto bid \$3.9 billion for Mozambique-based **Riversdale Mining Ltd**. Riversdale is listed on the ASX with a market capital of \$4.0 billion and operates coal mines in southern Africa. At the time of writing the purchase had not been finalised because the parties are still discussing the price.

Overall, 2010 was a very good year.

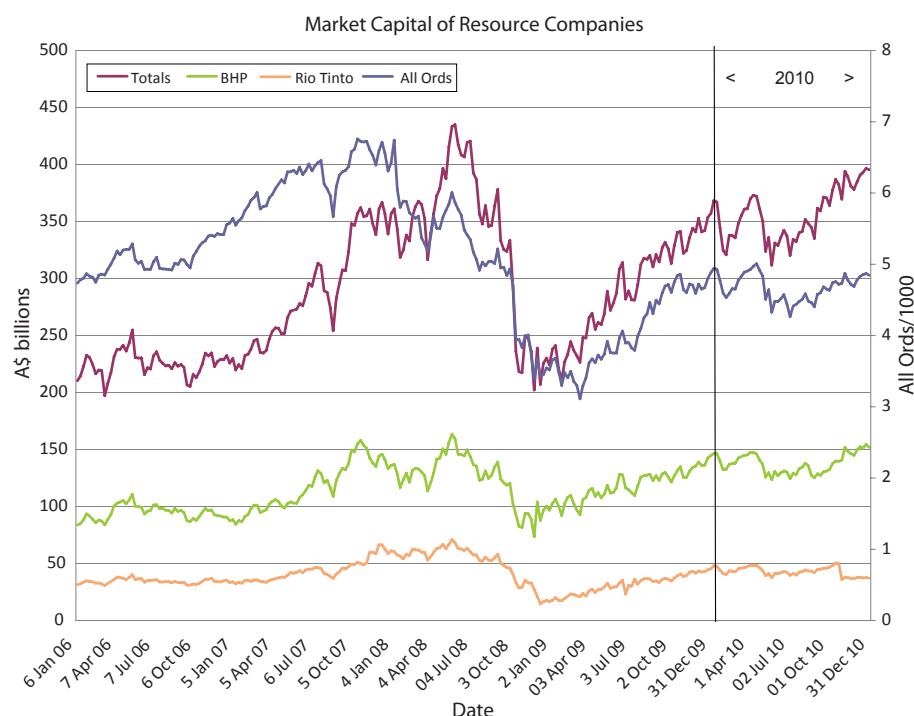


Fig. 1. Total market capital (in \$billions – left hand axis) of resource companies in the top 150 companies listed on the ASX (red), together with plots for the two largest resource companies, BHP and RioTinto. The All Ords index is plotted in blue (right hand axis). Notice that the resource companies out-performed the All Ords throughout 2010. None of the data have been adjusted for CPI increases.